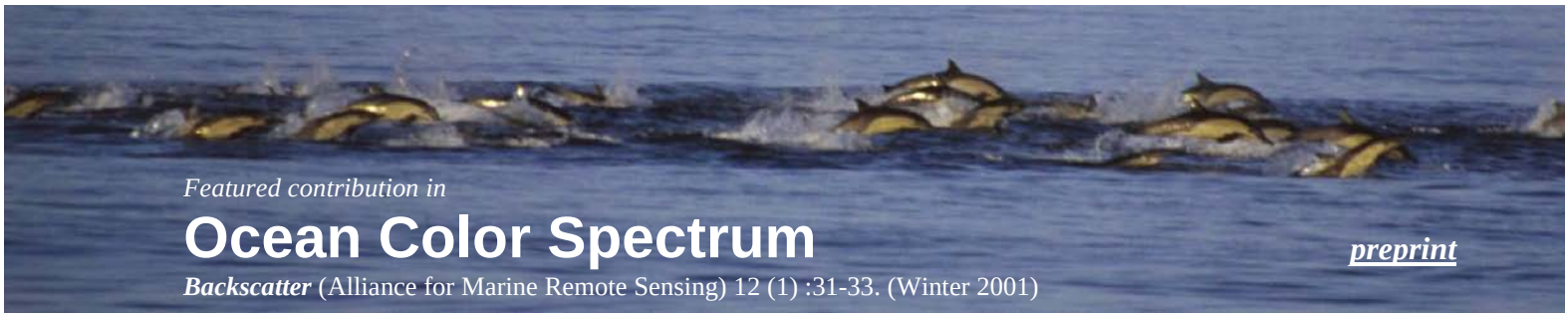

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A school of short-beaked common dolphins, the most abundant small cetacean in offshore waters of the Galápagos Archipelago. The typical size of these schools is about 270 animals, but they can aggregate in groups of 3,000 or more.

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Cetaceans (whales and dolphins) are at the top of the oceanic food chain. From this perspective, it is important to augment our understanding of the influence of oceanographic phenomena on cetacean patterns of occurrence. On the western side of the Galápagos Islands, strong environmental gradients result from the interaction between tropical and equatorial surface waters with the upwelled waters of the Equatorial Undercurrent. GalCet2K was a cruise designed to investigate mesoscale physical/biological interactions influencing the distribution and abundance of cetaceans in this region. The 15-day survey took place between 5-19 April 2000 aboard R/V *Odyssey*, as a collaborative effort between the authors and the Ocean Alliance, a non-profit whale research and conservation organization (http://www.oceanalliance.org).

In conducting habitat assessments for cetaceans, a compromise must often be made between the requirements necessary to obtain precise estimates of abundance, and an environmental sampling design that will resolve the scales of interest. This is complicated by the fact that, at the higher trophic levels, species-environment relationships are a function of complex trophic and life-history dynamics that are not easily measured. Therefore, we must rely on proxy variables that can be readily measured within the scope of a typical cruise. Our approach consisted of an intensive visual survey for cetaceans along the track of the vessel, while stopping two to three times per day to sample the upper 150 m of the water column with a small CTD instrument with an attached fluorometer. Along-track measurements of sonar intensity were also collected at two frequencies (50 and 250 kHz), as a bulk index of biomass of zooplankton and nekton (which are potential cetacean prey) (Figure 1). We relied on near-real-time satellite imagery of sea-surface temperature and ocean color to determine the optimal location of the survey site. A total of 1,760 km of trackline was surveyed within a 72,400-km^2 box. The number of cetacean sightings collected was 136. Of these, 94 were schools of small dolphins [belonging to four species: common (Figure 2), striped, spotted and spinner dolphins, in order of abundance], and 42 were sightings of medium- and large-sized cetaceans.

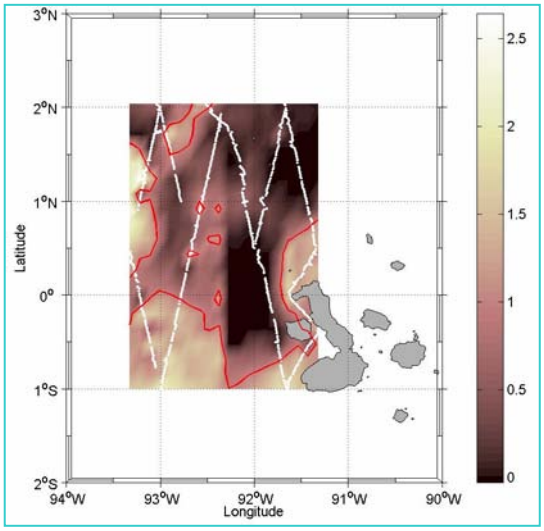

Figure 1. Water-column zooplankton/nekton biomass index integrated to 150 m, as derived from sonar returns (50 plus 250 kHz). Scale is arbitrary. Dotted white line depicts measurement locations and red contour indicates a biomass index of one.

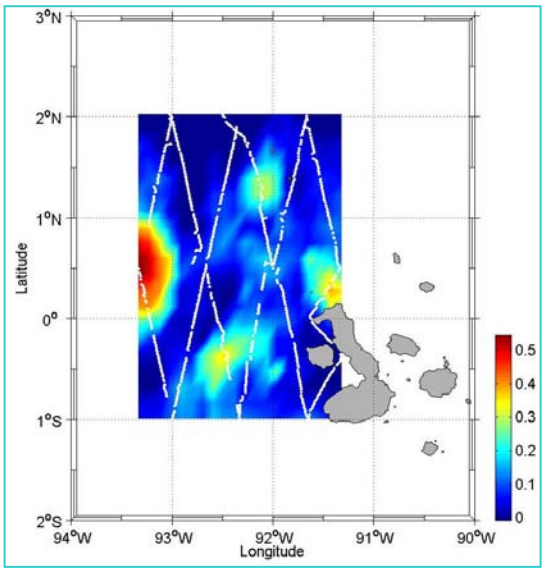

Figure 2. Common dolphin relative abundance (school sightings per 2-km of trackline) during GalCet2K. The distribution of schools of this species was very patchy. Some correlation with the distribution of high sonar returns is apparent. White line depicts the survey trackline.

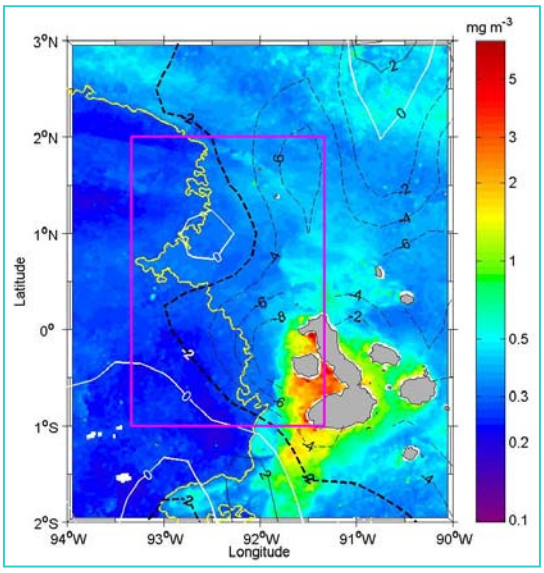

Figure 3. 15-day averages of SeaWiFS chlorophyll-a and TOPEX/Poseidon/ERS-2 sea-surface height anomaly (SSHA, contours), illustrating physical/biological mesoscale coupling. Increased phytoplankton abundance is observed in areas with below-average sea-level. Notice the similarity in the shape of the 0.3 mg m^{-3} contour (yellow line) and the -2 cm SSHA contour (with some spatial offset), in spite of the temporal averaging. Magenta line indicates survey box.

By virtue of their synoptic coverage, oceanographic measurements derived from satellites can be very useful in habitat assessments. We are using a multi-sensor approach to describe the mesoscale structure of the area surveyed, based on measurements of sea-surface height anomaly (TOPEX/Poseidon/ERS-2), sea-surface temperature (AVHRR), and phytoplankton abundance (SeaWiFS) (Figure 3). This will allow us to better understand the patterns seen in the in situ data. Future analysis plans include extracting data from the satellite imagery along the survey trackline, for incorporation into a multivariate analysis of cetacean habitat based on environmental variables.